SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR

SYLLABUS EFFECTIVE FROM: 2017-18

Course: M.Sc.
Subject: Materials Science
Semester : I

Total Credit: 04

Subject Code: PS01CMTS21

Subject Name: Basic Concepts in Materials Science

Unit	Unit Title	Weight-age (%)
1	Laws of thermodynamics, Thermodynamics functions, Heat capacity, Enthalpy, Internal Energy, Gibbs potential, Heat content, Entropy, Free energy, Reversible & ir-reversible process, Adiabatic process, carnot cycle, Refrigeration Engine,Gibbs Helmholtz equations and its limitation, Nernst heat theorem, Consequences of third law.	25%
2	Microstates and macrostates, thermodynamics probability. Derivation of distribution equation(s) following Maxwell – Boltzmann statistics and Bose-Einstein statistics.	25%
3	Concept of Engineering stress and strain, Elastic Deformation, Elastic properties, Anelasticity, Viscoelastic Behaviour of Materials , Plastic deformation of single crystal and polycrystalline materials, creep in materials, Fracture, Griffith theory, Fatigue Hardness.. Tensile testing, failure modes, bend testing, impact testing, fracture toughness, fatigue testing, creep testing, hardness testing of different materials(Metallic, Polymeric and Ceramic Materials).	25%
4	Heat capacity, Temperature dependence of heat capacity, Specific heats of solids, Latent heat, Melting point, Thermal expansion and kinetic theory, thermal conductivity and thermal diffusivity , thermal stresses.	25%

Reference Books:

Physical Chemistry – Rakshit
Thermodynamics for Chemists -- Glasstone
Thermodynamics, Kinetic Theory & Statistical Thermodynamics – F.W.Sears, G.Salinger
Molecular Statistics for Students of Chemisty -- L.A.Woodwar.
Materials Science and Engineering, An Introduction-William D. Callister

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Course: M.Sc.
Subject: Materials Science
Semester : I

Subject Code: PS01CMTS22 **Total Credit: 04**

Subject Name: INTERFACIAL ASPECT OF MATERIALS SCIENCE

Unit	Unit Title	Weight-age (%)
1	Introduction to Materials & Materials Science. Type of materials, **Smart materials** Properties of materials, levels of structure and **surface modification-etching**, grinding, processing of materials, structure- property – processing relationship. Environmental effect of Materials behavior, Materials selection.	25%
2	Adhesion science, Definition of terms, Adhesion between two dry solids, Adsorption forces at solid surfaces, nature of real surface, methods of achieving surface contact, the liquid-solid interface, Laplace law, Young equation, wetting characteristics, electrostatic theory of adhesion, mechanical theory of adhesion, diffusion theory of adhesion, weak boundary layers.	25%
3	Brief history, laws of friction and their interpretation, effect of surface topography, chemistry, mechanical and physical properties. Wear of materials including metals, ceramics, polymers and their testing. Types of wear, Influence of environmental aspects. Archard wear law, Beneficial wear. Lubrication, Lubricants, boundary and hydrodynamic theory. Effect of additive and viscosity on surface protection. Lubrication at low and high temperatures, theory of lubrications.	25%
4	Adsorption, desorption, adsorption of gases by solids, physical adsorption experimental methods, Langmuir, BET and other theories, specific surface area determination. Chemisorption and its importance in the oxidation of metal catalysis, catalyst and types of catalyst, materials science in catalyst, catalyst action.	25%

Reference Books:

Handbook of Adhesion by D E Packham
The Science and Engineering of Materials by Donald R Askeland
Handbook of Adhesive Technology by A Pizzi, K L Mittal
Catalyst by B. Viswanathanan
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SARDAR PATEL UNIVERSITY
Course: M.Sc.
Subject: Materials Science
Semester : I

Subject Code: PS01CMTS23 **Total Credit: 04**

Subject Name: THIN FILM MATERIALS

Unit	Unit Title	Weight-age (%)
1	Introduction, Mechanical pumps, Oil diffusion pump, sorption pumps, Getter pumps for generation of vacuum in different ranges. Leak detection and repair, vacuum measurements, vacuum gauges for low, medium and high vacuum ranges.	25%
2	Thermodynamics and kinetics foundation, equilibrium vapor pressure of materials, Clausius-Clapeyson equation, atomistic concept of gas pressure and temperature, impingement rate of molecules on a surface and free path of gas molecules.	25%
3	Substrate, substrate materials, substrate materials selection and their cleaning method, evaporation of compounds alloys and mixtures, special film evaporation techniques.	25%
4	Condensation, nucleation and growth of continuous thin films, film thickness and its impact on properties, deposition rate control. Adhesion and its importance, methods of measurement of adhesion. Electrical properties of thin films, sources of electrical resistivity in metallic conductors, commonly measured quantities, thin film resistors and resistor materials.	25%

Reference Books:

Vacuum Science and Technoligy- V.V. Rao, T.B. Ghosh and K.L.Chopra
Handbook of Thin films – Maissel and Glang
Thin film phenomena –K.L. Chopra
Preparation of Thin Films – Joy George

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Course: M.Sc.

Subject: Materials Science

Semester : I

Subject Code: PS01CMTS24 **Total Credit: 04**

Subject Name: POLYMER SCIENCE

Unit	Unit Title	Weight-age (%)
1	Basic concepts of high polymer system, macromolecular concept, structural feature of polymer, length to diameter ratio, classification, structure property relationship. Step reaction polymerization, radical chain polymerization, ionic and co-ordination polymerization, copolymerization.	25%
2	Polymerization techniques like bulk polymerization, solution polymerisation. suspension polymerisation, emulsion polymerisation, melt polycondensation, solution poly condensation, solid & gas phase polymerization. molecular weight distributions and averages, measurement principal methods & their range of applications, analytical techniques for molecular weight determination, GPC and HPLC.	25%
3	Chemical bonds, polymer solubility, chemical reactivity, effect of thermal, photochemical and high energy radiation, aging and weathering, diffusion and permeability, toxicity. Rheoproperties such as stress and strain, ideal elastic solid, newtonian and nonnewtonian fluid, apparent viscosity, the power law, molecular hole concept, waissenberg effect, measurement of flow, melt fracture, time dependent flow, viscoelastic material and its mechanical model, relaxation, hysteresis and creep.	25%
4	Polymer single crystals, lamellae, disorder & nature of the fold surface, crystallization from melt, degree of crystallisation, crystallits, structural regularity and crystallizability, factors affecting crystallisabillity, helix structure, spherulites. Configuration of polymer chains, crystal structure of polymer, morphology of crystalline polymer, crystallization and melting.Glass transition temperature, melting temperature, measurement methods, factors affecting glass transition temp and properties. Heat distortion temperature.	25%

Reference Books:

- Polymer Science by V R. Gowarikar
- Polymer Science and Tech. of Plastics and Rubber by P Ghosh
- Polymer Science by Billmeyer
- Introduction to polymers by R.J. Young and P.A. Lovell.

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Course: M.Sc.

Subject: Materials Science

Semester : I

Subject Code: PS01CMTS25 **Total Credit: 04**

Subject Name: PRACTICAL – I

Unit	Unit Title	Weight-age (%)
	1. Operation of vacuum coating unit. 2. Deposition of metallic thin film using vacuum coating unit. 3. Determination of specific heat of graphite at different temperatures 4. Estimation of thickness of film by multiple beam interferometry method. 5. Preparation of thin film resistor using vacuum coating unit. 6. Estimation of inter planar spacing and unit cell dimensions using electron diffraction pattern. 7. Determination of electrical conductivity of graphite at room temperatures. 8. Determination of depth of scratch by MBI method.	**100%**

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Course: M.Sc.
Subject: Materials Science
Semester : I

Subject Code: PS01CMTS26 **Total Credit: 04**

Subject Name: PRACTICAL – II

Unit	Unit Title	Weight-age (%)
	Preparation of phenol-formaldehyde resin (resole) Preparation of phenol-formaldehyde resin (Novolac) Preparation of urea-formaldehyde resin. Preparation of melamine-formaldehyde resin. Preparation of epoxy resin (Solid and liquid) Emulsion polymerization of methylmethacrylate. Preparation of unsaturated polyester. Determination of free phenol content in Novolac resin. Determination of Free formaldehyde in PF, and UF and MF resin. Determination of epoxy equivalent weight of epoxy resin. Determination of acid value in polyester.	**100%**

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Course: M.Sc.

Subject: Materials Science

Semester : I

Subject Code: PS01CMTS27 **Total Credit: 01**

Subject Name: Comprehensive Viva

Unit	Unit Title	Weight-age (%)
		100%